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ABSTRACT

Some of the ways of dealing with math anxiety through a learning center are discussed. These are: (1) offering a non-credit basic mathematics review class; (2) offering one-hour focus groups covering study techniques for entry level math and science courses; (3) sponsoring an informal group dealing with math anxiety; (4) making math anxiety desensitization tapes available in a self-help laboratory; and (5) developing positive liaisons with math department faculty. (MP)

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MATH ANXIETY:
WHAT CAN A LEARNING CENTER DO ABOUT IT?

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April 10, 1979

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At UT Austin, many students have expressed the need to improve their skills in mathematics. Some need only limited remedial work to prepare for a university math course; others require instruction in elementary arithmetic. But there is one problem that many of these students share: they are anxious about the thought of working on math problems. This experience has led us at RASSL/Learning Services to consider ways of confronting the problem of math anxiety.

Daniel (2:1) defines math anxiety as "a strong negative emotional reaction to math which prevents a person from coping with mathematics in the manner he wishes." Kogelman and Warren (5:10) define math anxiety as an intense emotional reaction which "guides and controls one's approach to math to such an extent that doing math becomes extraordinarily difficult if not impossible." A concept which appears in all definitions is the fact that math anxious people are unable to work math problems to the extent of their ability because of their emotional reaction to mathematics. It is this reaction which must be dealt with if a person is to overcome math anxiety.

The roots of the anxiety appear before college entrance for most individuals. For example, a math anxious man might have been ridiculed when he was in the eighth grade because he couldn't work a problem on the board, or a woman might have been counseled out of a math class in high school because

her counselor thought she wouldn't succeed in a math class. Whatever the cause, math anxiety can be treated. This paper will show some of the ways our staff has chosen to deal with math anxiety.

We at RASSL have begun to confront this problem, through a variety of approaches, by: 1) offering a non-credit basic mathematics review class; 2) offering one hour focus groups covering study techniques for entry level math and science courses; 3) sponsoring an informal group dealing with math anxiety; 4) making math anxiety desensitization tapes available in our self help lab; and 5) developing positive liaisons with Math Department faculty.

To participate in any of our programs, a student must first see a learning specialist available during our office hours. A typical consultation with a student will assess the student's needs and prescribe the program which will best meet those needs. All learning specialists are sensitive to the problem of math anxiety and are able to guide a student into any appropriate RASSL program depending on the individual's needs.

The following is a description of our math anxiety reduction programs and a description of the students who can benefit most from each type of program.

Basic Math Review Class

A major cause of math anxiety is a lack of basic mathematical skills. Many people graduate from high school with inadequate math skills. This is a source of anxiety as they realize mathematics is a possible obstruction in their college major or career. Berkeley sociologist Lucy Sells (7:1) calls math a "critical job filter" because of the limiting effects of a lack of mathematical skills. In addition to the limitations that weak math skills present in pursuing certain careers, students may have a variety

of other reasons for wanting to improve their skills in mathematics. For example, some students are interested in raising their skills to a level where they may enter a university level math course. Others are interested in preparing for the math section of the GRE. Consequently, we have chosen to offer the Basic Math Review class.

The Basic Math Review class meets for 19 sessions of 1 1/4 hours each. (see Appendix A). The first 5 sessions cover arithmetic, the next 13 cover high school algebra, and the last session covers important concepts of geometry. The course is open entry/open exit so a student may begin the course at any session or drop at any time. Some students have chosen to begin the course when the algebra sessions begin rather than at the beginning of the arithmetic sessions. The complete course is also available in our self help lab and may be studied on a self-paced basis.

The content of the course, however, is not as important as the mode of delivery and style of the instructor. In order to reduce anxiety, it is necessary to keep a non-threatening, non-competitive atmosphere. This atmosphere can be maintained by a sensitive attitude on the part of the instructor. Occasionally, comics dealing with some aspect of mathematics or riddles are brought to class as teaching aids. Whenever possible, the instructor gives positive reinforcement to students for doing well. Skills are taught and there is a constant emphasis on understanding why you do what you do in the given situations so the students may apply the learned concepts to different settings. At times, the material covered is easy for the students. It is the intention of the instructor to reduce the students' anxiety by their success in understanding these mathematical concepts. Because students will feel more confident if they know how to approach problems, the

instructor emphasizes problem solving strategies throughout the course.

Each session follows the same format. Work from the previous session is reviewed, new material is presented by lecture, and problems are distributed and worked on either independently or in groups while the instructor circulates and answers questions. The instructor distributes homework problems for students seeking additional practice.

Learning specialists are aware that a cause of math anxiety could simply be a lack of mathematical skills. During conferences, students are questioned to see if this is the reason for their anxiety. Many times students are referred to this class if they lack basic skills in mathematics.

Upon completion of this course, students have shown increased confidence in math allowing them to continue their study of the subject. Some typical comments made on course evaluations by students have been as follows:

"(Class) was informal yet informative which allowed the student to not fear criticism - thus reducing anxiety usually associated with math problems."

"(Instructor) did a good job of proving everyone can do math."

"(Instructor) was very patient with us."

Focus Groups

Some students experience difficulty in math courses because they do not know how to study mathematics. Much of their time is spent reading and memorizing because they do not have more effective approaches to studying math. This lack of effective study skills may lead to anxiety.

In order to improve math study skills, we offer hour long focus groups which cover study techniques for specific entry level courses in math and chemistry. A learning specialist discusses notetaking, problem solving, and

test preparation in general and then applies these techniques to specific examples from the course. Test preparation techniques are applied to chapters which are covered in class. At times, a learning specialist will attend a class for a few weeks to make sure the presentation will be relevant to the course.

By offering focus groups, we intend to reduce the students' anxiety by teaching them improved study techniques for math and science. A learning specialist will refer students to these groups if they are taking the course which the focus group is covering. For added publicity, announcements are made in large lecture classes by a learning specialist and announcement letters are sent to all instructors who are teaching the course which is being covered in the group.

Math Anxiety Workshop

The Math Anxiety Workshop is a five week workshop led by the chairman of the Math Department and a professor in the School of Social Work. The intent of the workshop is not to provide instruction in math, but rather to help each participant discover the nature of his math anxiety and make changes that will help with his specific concerns. The participant is taught the nature of his anxiety by specifically recalling instances in his life when he felt anxious about math. The facilitators aid him in discovering the specific feelings and thoughts he may have experienced in mathematical situations. The participant is then encouraged to identify specific changes he would like to make. At that point, the student makes a contract with the leaders to change his reactions in similar situations. The contracts are very precise and the leaders are very careful to make sure that the goals of the contract are attainable. Later, the participant reports back to the group on how he did on his contract.

The philosophy of the leaders is that each participant should learn that he is in control of his interpretations of and reactions to mathematical events.

There are a variety of reasons why a student may enroll in a math anxiety workshop and a variety of changes that different students may experience. For example, the leaders do not assume that all students must learn math to overcome their anxiety. For some students, it is reasonable for them to conclude that it is all right that they are bad at math and it is all right to accept that fact. Others have used the workshop as a support group while enrolled in a university math course. Some students who have realized that a lack of basic skills is the source of their anxiety have enrolled in the Basic Math Review class after a few workshop sessions. This decision is facilitated by the fact that the instructor of the Basic Math Review class attends the Math Anxiety Workshop and the students learn about the non-threatening nature of the class.

Although the Math Anxiety Workshop is not led by a learning specialist, RASSL sponsors the workshop and does all of the initial screening of the workshop's participants. Learning specialists must ascertain whether the workshop is an appropriate referral. Students are questioned about their math background, their current math skill level, their current problem solving skills, and their current study skills in math. For students simply lacking some type of skill and who are able to recognize that fact, the workshop may not be a proper referral. For example, students weak in basic math skills are referred to the Basic Math Review class. Students who experience strong negative reactions when trying to deal with mathematics are good referrals to the workshop. It is possible for some students to have completed an advanced math course such as calculus and still be math anxious. Such students would be referred to the workshop.

Many students felt the most valuable part of the workshop was their sharing of experiences with other students because it allowed them to see that others shared their same anxieties. Additionally, most students have shown less anxiety on math anxiety rating scales after completing the workshop.

Math Anxiety Desensitization Tapes

Stress and anxiety are not caused by certain events themselves, but by our interpretations of these events. A student could easily find himself in a mathematical situation where anxiety could be caused by a negative interpretation of the situation. It is helpful to alter these perceptions associated with the situation and, consequently, alter the anxiety response.

To serve this purpose, math anxiety desensitization tapes (8) are available in our self help lab. This series of five tapes provide the student with a systematic desensitization of math anxiety.

The purpose of the tapes is to first get the student calm and relaxed. When this is achieved, a stressful mathematical situation is presented. At this point, the student must learn to cope with this situation in a calm manner. By use of this process, images of possible unpleasant outcomes from the actual event can be decreased.

The Math Anxiety Desensitization tapes can serve as a useful alternative to the Math Anxiety Workshop. Students who do not feel comfortable in group situations can profit more by dealing with their math anxiety through self help. These tapes are also available for students who have a schedule conflict and are unable to attend the Math Anxiety Workshop.

Liaison with the Math Department

All of our math anxiety reduction programs need the support of the Math Department to be as successful as they have been. A good program begins with

proper communication. The Math Department is continually made aware of all our programs and we receive much publicity from individual members of the faculty. We are also available as consultants for the department concerning any learning problems its students may have. Additionally, if individual faculty members have suggestions, we're always listening.

A learning specialist has made presentations to teaching assistants in the Math Department. These presentations cover math anxiety and its causes, and give the teaching assistants recommendations about how they can help students with this problem. It is our intention that teaching assistants' awareness of math anxiety will make them more sensitive to their students' needs.

CONCLUSION

The best way to confront math anxiety is to hire a math learning specialist sensitive to the needs of the students. However, in an age of tight budgets, this may not be possible. What are some alternatives?

1) Develop strong liaisons with math faculty.

If math professors are aware of the problem, they can ease math anxiety by making their classes less threatening and more supportive. Learning specialists can make presentations to faculty on math anxiety. Also, a learning specialist who may have experienced math anxiety himself should be well qualified to give mathematicians valuable insight into the problem of math anxiety.

In addition, learning specialists can serve as consultants in study techniques for math. Professors should constantly be teaching their students more effective study techniques and problem solving strategies while teaching their course material; learning specialists can encourage these approaches. Much of the material covered in focus groups is really material which professors could cover in their classes.

Math anxiety can be reduced if students have a means of learning prerequisite

material for the math courses in which they are enrolled. For example, most entry level courses assume an adequate algebra background. Some commercial materials (3) are excellent for review of this subject. A stronger interrelationship with the Math Department can be developed by making prerequisite material for entry level math courses available in the learning center.

2) Hire student paraprofessionals.

Those students who are math anxious because of a lack of skills of proper study techniques can be served by their own peers. Peer tutors can teach their students more effective study techniques and problem solving strategies. Also, a student in math education could gain valuable experience by teaching a course similar to the basic math review course.

3) Use your own resources.

Math anxiety desensitization tapes can be made available in your self help lab. Students can profit from these tapes on their own without the aid of a learning specialist.

Math anxiety reduction groups can be offered. Many counselors are interested in math anxiety reduction and could serve as an excellent group co-leader with a learning specialist. Some math anxiety reduction groups do not teach math, but they work at changing students' negative reactions toward mathematical situations. Such a group does not need a mathematician to be successful, although a sensitive mathematician could make valuable contributions.

Learning specialists with a solid high school background are capable of teaching a class such as Basic Math Review. Commercial books (1) can be used as textbooks for this course. Learning specialists can do a good job because many problem solving skills are closely related to reading skills and because learning specialists are sensitive to learning and anxiety problems (4).

Math anxiety is a major factor in many students' academic lives because it affects not only their self esteem as students, but also their choices in academic and career pursuits. Learning center personnel, because of their sensitivity to students' affective as well as academic needs, are ideally suited to address the issue of math anxiety. The problem can be addressed through improving students' study skills in math, offering background math skills development, or offering math anxiety reduction programs. Any or all of these approaches will provide a valuable service to math anxious college and university students.

Appendix A

BASIC MATH REVIEW

	CONTENT
Session 1	Fractions
Session 2	Decimals (and their relation to fractions)
Session 3	Ratios and proportions
Session 4	Percents and related word problems
Session 5	Positive and negative numbers
Session 6	Polynomial arithmetic
Session 7	Factoring polynomials
Session 8	Rational Expressions
Session 9	Rational Expressions
Session 10	Roots and powers
Session 11	Solving algebraic equations
Session 12	Word problem solving
Session 13	Word problem solving
Session 14	Quadratic equations
Session 15	Graphing and functions
Session 16	Solving simultaneous equations
Session 17	Using dimension symbols (good for future Chem students)
Session 18	Geometry

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